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**HIGH VACUUM FACILITY FOR HYDRAZINE THRUSTER TESTING**

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**ABSTRACT**

This paper describes an ongoing modification of a large (30-foot sphere) vacuum chamber to accommodate the ignition of an arcjet hydrazine thruster while maintaining a vacuum level of  $1.0 \times 10^{-5}$  torr or less. The vacuum facility consists of a 20-foot stainless steel vacuum tank with an internal  $LN_2$  shroud, four 35-inch cryopumps and an 8-inch turbopump. To maintain a vacuum level of  $1.0 \times 10^{-5}$  torr or less, 900 sq. ft. of liquid helium (LHe) shroud surface has been installed to maintain the vacuum level and pumping requirements in Table I.

A vacuum level of  $1.0 \times 10^{-5}$  torr or less will allow the hydrazine thrust to exit the thruster nozzle and radiate into a space type environment so that plume flow field can be analyzed and compared to the analytical model density distribution profile. Some of the other arcjet thruster characteristics that will be measured are the electromagnetic interference (EMI) and exhaust contamination. This data will be used to evaluate if the arcjet thruster with its high specific impulse (450 sec, average) in comparison to current chemical propulsion thruster can be used for the next generation of communication satellites.

The LHe system is gravity-feed, with external LHe dewars that supply an internal 5001 LHe dewar with a phase separator which in turn supplies the LHe shrouds. The LHe shroud panel temperature must be maintained at 4.8°K or less to retain the hydrogen in a solid state on the LHe shroud panels. The hydrogen is a by-product of the hydrazine from the exhaust plume. The LHe shroud system consists of five 6-foot-wide by 15-foot-long shroud panels which are located inside the vacuum chamber. Each LHe shroud panel is positioned inside the chamber so the thruster plume will not radiate directly on the LHe shrouds.

The test is scheduled to start on May 1, 1990 and the data will be available on June 1, 1990.

Table I. Facility Pumping Capability and Arcjet Thruster Specifications

<u>Facility Pumping Capability</u>	
4 -- 35" Cryopumps	
1 -- 8" Turbopump	
30-foot-diameter 80°K Shroud	
900 square feet of LHe Shroud with the following pumping capability:	
N <sub>2</sub>	24.4 torr 1/sec
H <sub>2</sub>	48.3 torr 1/sec
<u>Arcjet Thruster Operational Specifications</u>	
Hydrazine Flow Rate	$1.0 \times 10^{-4}$ lbm/sec
Ignition Duration	16 hours
Vacuum Level Required	$1.0 \times 10^{-5}$ torr or less
Thrust	0.038 – 0.045 lbf